EXAM 2
ZOOLEGY 313 - Spring 2003

Provide a short answer to each of the following questions. Keep the answers short—in many cases a few words or a short phrase will do. PUT YOUR NAME ON ALL PAGES

1. Olfaction
   a) Define what “pheromones” are and give an example of a pheromone (2 pts.)

   Chemical signal produced by one animal and influencing behavior of another animal of the same species

   b) Name one advantage and one disadvantage of using chemical signals for communication, as compared with other sensory modalities (2 pts.)

   Advantages: work in darkness, moves around barriers, persists in environment so information is carried “into the future”
   Disadvantages: may be degraded, hard to aim, hard to modulate

2. Bat echolocation
   a) How do bats use the echos of their vocalizations to determine the distance from themselves to an object in the environment? (3 pts.)

   Time elapsed from emission of sound to return of echo

   b) How do bats use the echos of their vocalizations to determine whether an object is moving toward them or away from them? (3 pts)

   Doppler shift of echo relative to outgoing signal

3. Magnetoreception: Explain the difference between a polarity compass and an inclination compass (a diagram may help). (3 pts)

   Polarity compass detects polarity of field lines directly (like the magnetized needle on a hand-held compass)
   Inclination compass detects the “dip” of the earth’s field lines... “north” (or “poleward”) is the direction in which the field lines make the smallest angle relative to gravity

4. In some species of songbirds, the females may sing during part of the year. For example, in mockingbirds, females sing during the winter (males sing during the breeding season—spring and summer). Propose two hypotheses for why the female may sing.

   Hypothesis 1: (2 pts)
   Hypothesis 2: (2 pts)

   Some hypotheses to choose from (should be functional/ultimate):
   1. Defend feeding territories against conspecifics
   2. Defend territories against other species
   3. Helping sons learn songs
   4. Attracting mates?
5. Communication:
   a. Briefly explain why we would expect honesty to be a common attribute of animals’ signals (2 pts.)
      
      **Receivers should be strongly selected to ignore dishonest signals**

   b. Under what circumstances should dishonest signals evolve? (2 pts.)
      
      **Benefit to receiver of detecting dishonest signals may not outweigh costs (e.g., taking extra time to check out possible liars, and in the process exposing yourself to risk of predation or missing out on mating opportunities)**

6. In lecture I stated that both positional and directional information are necessary for navigation—i.e., you need both of them to find your way to a goal.

   a) Explain why you need both, i.e., why either a positional or a directional sense by itself would not be enough (2 pts.)
      
      **Positional sense tells you which is the correct direction, but not which direction is which**
      **Directional sense allows you to discriminate directions, but not which is the correct direction toward your goal**

   b) Consider your ability to head toward Spartan Stadium from Giltner Hall. What positional and directional information do you have available to solve this navigational task? (4 pts.)
      
      Positional: **Landmarks (buildings, roads) learned through previous experience**
      
      Directional: **Landmarks, sun, magnetic compass if you have one handy**

7. Vervet monkey alarm calls.
   a) List at least two ways in which the alarm calls of Vervet monkeys resemble words in human language (2 pts.)
      
      **Here are four ways: they are elicited by distinct objects in the environment, they evoke distinct responses, there is an arbitrary association between sound and meaning, and there is a role of learning in their development**

   b) What is are two differences between Vervet alarm calls and words in human language? (2 pts.)
      
      **Here are three ways: No evidence that Vervet words can be put together into sentences, their production and use is not mediated by a “Theory of Mind”, repertoire is very limited**
8. Consider the following facts about spatial learning in rodents (voles and mice) discussed in lecture and/or the book:

- Male spatial learning ability doesn’t change seasonally even though the testosterone levels in their blood do change seasonally. **In this case testosterone levels don’t affect spatial learning ability**
- Females that undergo embryonic development in a male-biased litter (where they would be exposed to high testosterone levels) are no different from males in the Morris water maze task, and learn faster than females from female-biased litters. **In this case testosterone exposure does affect spatial learning.**
- High estradiol levels (caused by estrus or by experimental injection of estradiol) in females are correlated with slower spatial learning in the Morris water maze task. **Thus estradiol impairs spatial learning.**

   a. Offer a hypothesis that would explain the conflicting evidence about the role of testosterone in spatial learning. Note: this is a proximate question. (3 pts.)
   
   **Testosterone plays organizational but not activational role**

   b. Offer a functional hypothesis that would explain why estradiol impairs performance in spatial learning tasks. (3 pts.)
   
   **Some possibilities:**
   
   (i) Females don’t need spatial memory and estradiol is mechanism for keeping them close to home and hence safe
   
   (ii) The changes in brain associated with estrus interfere with brain mechanisms needed for spatial memory, thus the effect on spatial memory is non-adaptive by-product of tradeoffs in brain function

9. Following are two examples of navigational phenomena involving learning. Discuss whether either of them can be viewed as an example of associative learning, and if so which type of associative learning (trial-and-error learning or classical conditioning) the learning resembles.

   a. Hatchling sea turtles learning the magnetic heading corresponding to the offshore direction that the experience while swimming through the waves. (3 pts.)
   
   **You could think of it as either classical or trial-error conditioning:**
   
   Classical: Initially neutral E1 (magnetic direction of y-axis) is associated with initially meaningful E2 (direction into waves, which evokes swimming response)
   
   Trial and error: Animals try out different magnetic headings and are rewarded for finding the one that is aligned into the waves
   
   b. Pigeons learning the directions from which different environmental odors arrive on the wind, which they then use to develop an “olfactory map” that can help them determine their position after displacement from home. (3 pts.)
   
   **This doesn’t really work as classical conditioning, because there is no initially meaningful E2. It could be trial and error conditioning, though: while exploring environment, pigeons are rewarded for going in certain directions relative to certain odors**
10. Rhythms. You observe an animal varying its behavior on a daily schedule, for example, foraging and engaging in social behavior at night and hiding and sleeping during the day.

a. What experimental evidence would allow you to determine whether this schedule is influenced by an endogenous clock, or if the animal is simply responding to the daily light-dark cycle? (3 pts)
   Put it in constant light or constant dark; if rhythm persists, rhythm is endogenous, or at least not responding to light

b. List two additional questions you might ask in order to find out more about the mechanisms underlying the behavioral rhythmicity you have observed. (4 pts.)
   Some possibilities:
   - What is Zeitgeber?
   - How does tau change over time?
   - Where in brain is clock?
   - Is signal from clock neuronal or humoral?
   etc